ORIGINAL RESEARCH PAPER

Medical Science

COMPARISON OF THE EFFICACY AND SAFETY OF DIFFERENT METHODS OF POSTERIOR SUBTENON STEROID INJECTION

KEY WORDS: Cystoid macular edema, diabetic cystoid mecular oedema, posterior uveites vitritis, pars planitis, subtenon injection, OCT, central macular thickness.

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ABSTRACT

- Cystoid macular edema (CME) is a frequent cause of reduced central vision. It is a nonspecific pathologic response to a variety of ocular conditions and diseases, including many retinal vascular and chorioretinal diseases. Essentially, any condition inducing intraocular inflammation, retinal vascular occlusion, or retinal traction may be associated with CME.
- Periocular corticosteroids, either given in a sub-tenon's or retrobulbar fashion, may be useful in patients with:
- Uveitis-associated cystoid macular edema,
- Diabetic cystoid macular edema
- Some forms of intermediate and posterior uveitis
- Two methods for posterior subtenon's steroid injection have been described:

(1) The Smith and Nozik method
(2) The Cannula method

Aim

- To compare the efficacy of posterior subtenon's triamcinolone injection given by two different methods- Smith and Nozik technique and Cannula method in patients of Cystoid Macular Edema, Intermediate uveitis, Vitritis and Pars planitis in terms of the improvement in visual acuity and changes in Ocular Coherence Tomography findings
- To compare the side effects in terms of subjective pain at the time of injection and the rise in Intra ocular pressure by these two methods
- A total of 30 consecutive patients with cystoid macular edema, who satisfied the inclusion criteria , were randomly allocated to 2 different groups, each containing 15 eyes of 15 patients.
- In each group PST injection was given by either of the 2 methods: the cannula method and the Smith and Nozik method.
- The change in visual acuity and the central macular thickness on OCT, the rise in intraocular pressure and the pain score at the time of receiving the injection were compared between the two groups.

OBSERVATIONS

- In this study, we found a statistically significant improvement in BCVA after posterior subtenon's injection of triamcinolone acetonide by both methods by applying the paired t test (two tailed t test) and taking p value <0.05 as statistically significant.
- Also, the final change in best corrected visual acuity was higher in Group 1 (Canula method) than in Group 2 (Smith and Nozik technique) and this difference was found to be statistically significant by applying the paired t test (two tailed t test) and taking p value <0.05 as statistically significant..
- On comparing the OCT findings, there is a statistically significant decrease in Central Macular Thickness after posterior subtenon's injection of triamcinolone acetonide by both methods.
- The final change in CMT was found to be higher in Group 1 (Canula method) than in Group 2 (Smith and Nozik technique) and this difference was found to be statistically significant by applying the paired t test (two tailed t test) and taking p value <0.05 as statistically significant..
- Analyzing the rise in intra-ocular pressure,there is no statistically significant rise in IOP (at week 6) after posterior subtenon's injection of triamcinolone acetonide by either of the two methods by applying the paired t test (two tailed t test) and taking p value <0.05 as statistically significant..
- The pain score was significantly higher in group 2 (Smith and Nozik technique) compared to group 1 (canula method) by applying the paired t test (two tailed t test) and taking p value <0.05 as statistically significant..

Conclusion : Hence our study suggests that the cannula method is an equally efficacious alternative to the more widely used Smith and Nozik method and may be safer, as a sharp needle is avoided after the initial entry is done under visualization.

INTRODUCTION

Cystoid macular edema (CME) is a frequent cause of reduced central vision. It is a nonspecific pathologic response to a variety of ocular conditions and diseases, including many retinal vascular and chorioretinal diseases[1]. Essentially, any condition inducing intraocular inflammation, retinal vascular occlusion, or retinal traction may be associated with CME[2].

If CME is refractory to topical medicines, repository steroids should be considered. Methylprednisolone acetate or triamcinolone acetonide can be given in the sub-tenon's space or in the retrobulbar location for a more concentrated and constant dose of anti-inflammatory medicine.[3-6] The injection can be repeated after 3 months

PERIOCULAR STEROIDS

Periocular steroid injection involves placement of steroid around the eye to treat intraocular inflammation or CME. Periocular steroids are active for a period of time (weeks to months) and can cause resolution of CME and intraocular inflammation[7-8].

A. INDICATIONS:

Periocular corticosteroids, either given in a sub-tenon's or retrobulbar fashion, may be useful in patients with:

a. Uveitis-associated cystoid macular edema,
b. Diabetic cystoid macular edema
c. Some forms of intermediate and posterior uveitis

Two methods for posterior subtenon's steroid injection have been described:

(1) The Smith and Nozik method
(2) The Cannula method

The **Smith and Nozik method** of posterior subtenon injection is

the most common method employed throughout the world for steroid delivery.

The **Cannula method**, described recently, theoretically seems to be a more effective and safe method because in this method placement of the steroid is done close to the macula with a soft polytetrafluoroethylene cannula[10].

AIMS AND OBJECTIVES

- To compare the efficacy of posterior subtenon's triamcinolone injection given by two different methods- Smith and Nozik technique and Cannula method in patients of Cystoid Macular Edema, Intermediate uveitis, Vitritis and Pars planitis in terms of the improvement in visual acuity and changes in Ocular Coherence Tomography findings
- To compare the side effects in terms of subjective pain at the time of injection and the rise in Intra ocular pressure by these two methods

MATERIALS AND METHODS

The study was conducted in the Upgraded department of Ophthalmology, LLRM medical college, Meerut, India.

STUDY DESIGN : A prospective randomized interventional study

INCLUSION CRITERIA

- CME secondary to intermediate uveitis, vitritis or pars planitis of noninfectious etiology and due to other etiology (e.g., post-surgical, diabetic) with a best corrected visual acuity less than/equal to 6/9 and adequate media clarity to enable documentation using OCT

EXCLUSION CRITERIA

- Patients with history, clinical features, and investigations suggestive of infectious etiology
- Any associated macular pathology (e.g., subretinal scarring/epiretinal membrane/macular hole)
- Intraocular pressure (IOP) at baseline > 21 mmHg
- Patients who had received a posterior subtenon injection in the preceding 3 months
- Opaque media.

PATIENT SELECTION :A total of 30 consecutive patients with cystoid macular edema, who satisfied the inclusion criteria , were randomly allocated to 2 different groups, each containing 15 eyes of 15 patients.

In each group PST injection was given by either of the 2 methods: the cannula method and the Smith and Nozik method.

Written informed consent was obtained and patients were selected after assessment :

PROCEDURE

Posterior Subtenon's Injection was given by one of the two techniques
(1) the Smith and Nozik method, and
(2) the cannula method

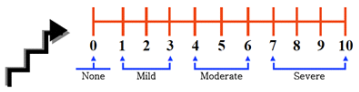
FOLLOW UP

Snellen'svisual acuity, slit-lamp examination, slit-lamp biomicroscopy with +9O D, indirect ophthalmoscopy, and applanation tonometry were recorded at day 0, 1st week, 6th week and 12th week.

OCT was conducted at day 0, 6th week and 12th week.

PAIN SCORING

Pain experienced while receiving the injection was also rated by the patient immediately after receiving the injection.

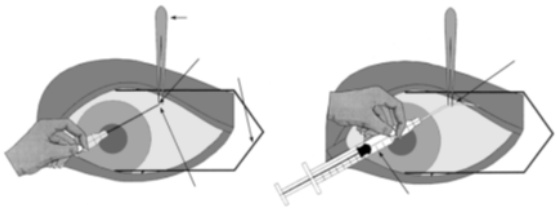


PROCEDURE

The methods of PST injection of triamcinoloneacetonide 0.5 mL (20 mg) employed in this study are as follows:

Group 1: Cannula Method

In all aseptic precautions entry is made into the episcleral space using the stillete of a 24-gauge intravenous cannula made of polytetrafluoroethylene. The stillete (with bevel up) and cannula are advanced together for about 3 mm within the episcleral space under direct visualization. The cannula is further advanced simultaneously withdrawal of stillete with rotatory movement. When the cannula has advanced about 12–14 mm posteriorly in subtenon space, the stillete is completely withdrawn and a syringe loaded with triamcinolone acetonide is attached to the cannula and 0.5 mL (20mg) triamcinolone is injected.



Group 2: Smith and Nozik Method

Syringe filled with 0.5mL(20 mg) of triamcinolone and fitted with 26-gauge needle is advanced with bevel facing toward the globe, supero-temporally along the curve of the globe.

The needle is advanced till the hub touches the conjunctiva.

Plunger is slightly withdrawn to rule out injecting steroids within a vessel. 0.5 mL of triamcinolone is injected and needle is withdrawn.

OBSERVATIONS AND RESULTS

1. AGE – SEX DISTRIBUTION (OVERALL)

AGE GROUP (YRS)	TOTAL NO. OF CASES	MALES	FEMALES
21-40	4	2	2
41-60	17	10	7
>60	9	6	3
Total	30	18 (60%)	12 (40%)

2. INDICATIONS FOR RECEIVING PST INJECTION

INDICATION	NO. OF PATIENTS IN GROUP 1	NO. OF PATIENTS IN GROUP 2	PERCENTAGE OF TOTAL PATIENTS
1. Diabetic macular edema (Cystoid)	9 (15)	8(15)	56.67 %
2. Vitritis / Pars plantis with CME	3 (15)	4 (15)	23.33 %
3. Other causes of CME	3 (15)	3 (15)	20 %

3. SNELLEN'S VISUAL ACUITY

GROUP 1 (Cannula method)
(No. of patients in each category)

Snellen's Visual Acuity	Baseline	Week 1	Week 6	Week 12
< 6/36	6	2	1	1
6/36 – 6/12	7	10	10	9
> 6/12	2	2	4	5

GROUP 2 (Smith and Nozik method)
(No. of patients in each category)

Snellen's Visual Acuity	Baseline	Week 1	Week 6	Week 12
< 6/36	8	5	1	1
6/36 – 6/12	7	10	13	13
> 6/12	0	0	1	1

4. Average Snellen's Visual acuity (Decimal equivalent)

Visual acuity	Group 1 (Canula)	Group 2(Smih and Nozik)
Baseline	0.26	0.19
Week 1	0.33	0.21
Week 6	0.39	0.27
Week 12	0.47	0.30

The average difference in final visual acuity (week 12) from the baseline in ***Group 1***was analyzed after applying **Paired *t* test** (two tailed t test) and taking P value as < .05 as statistically significant.

N=15	Baseline	At week 12
Mean	0.265	0.470
SD	0.195	0.192
SEM	0.050	0.049

(SD= Standard deviation, SEM= Standard Error of Mean)
t = 6.15

P <0.0001 and this was considered to be statistically extremely significant.

Hence there is a statistically significant improvement in BCVA after posterior subtenon's injection of triamcinolone acetonide by canula method.

The average difference in final visual acuity (week 12) from the baseline in ***Group 2***was also analyzed after applying **Paired *t* test** (two tailed t test) and taking P value as < .05 as statistically significant.

N=15	Baseline	At week 12
Mean	0.186	0.303
SD	0.132	0.156
SEM	0.034	0.040

(SD= Standard deviation, SEM= Standard Error of Mean) t = 4.562

Two tailed p value = 0.0004 and this was considered to be statistically extremely significant.

Hence there is a statistically significant improvement in BCVA after posterior subtenon's injection of triamcinolone acetonide by Smith and Nozik technique.

The average change in visual acuity (difference between BCVA at week 12 and at baseline) attained in the two groups was also compared statistically after applying **Paired *t* test** (two tailed t test) and taking P value as < .05 as statistically significant.

N=15	Change in BCVA at week 12 in group 1 (Canula method)	Change in BCVA at week 12 in group 2 (Smith and Nozik technique)
Mean	0.214	0.117
SD	0.134	0.099
SEM	0.034	0.026

(SD= Standard deviation, SEM= Standard Error of Mean) t = 2.20

Two tailed p value = 0.0448 and this was considered to be statistically significant.

Hence the final change in best corrected visual acuity was higher in Group 1 (Canula method) than in Group 2 (Smith and Nozik technique) and this difference was found to be statistically significant.

Mean Central Macular thickness on OCT

CMT (mean value in microns)	Group 1	Group 2
Baseline	399.3	419.1
Week 6	318.9	361.2
Week 12	282.7	336.6

The average difference in final Central macular thickness (week 12) from the baseline in ***Group 1*** was analyzed after applying **Paired *t* test** (two tailed t test) and taking P value as < .05 as statistically significant.

N=15	Baseline	At week 12
Mean	399.3	282.7
SD	81.82	82.68
SEM	21.12	21.35

(SD= Standard deviation, SEM= Standard Error of Mean) t = 4.75

P <0.00013and this was considered to be statistically extremely significant.

Hence there is a statistically significant decrease in Central Macular Thickness after posterior subtenon's injection of triamcinolone acetonide by canula method.

The average difference in final Central Macular Thickness (week 12) from the baseline in ***Group 2*** was also analyzed after applying **Paired *t* test** (two tailed t test) and taking P value as < .05 as statistically significant.

N=15	Baseline	At week 12
Mean	419.1	336.6
SD	80.54	72.08
SEM	20.80	18.61

(SD= Standard deviation, SEM= Standard Error of Mean) t = 7.57

Two tailed p value <0.0001 and this was considered to be statistically extremely significant.

Hence there is a statistically significant decrease in CMT after posterior subtenon's injection of triamcinolone acetonide by Smith and Nozik technique.

The average change in Central macular thickness (difference between CMT at week 12 and at baseline) attained in the two groups was also compared statistically after applying **Paired *t* test** (two tailed t test) and taking P value as < .05 as statistically significant.

N=15	Change in CMT at week 12 in group 1 (Canula method)	Change in CMT at week 12 in group 2 (Smith and Nozik technique)
Mean	116.67	82.51
SD	53.69	30.86
SEM	13.86	7.97

(SD= Standard deviation, SEM= Standard Error of Mean) t = 2.18

Two tailed p value = 0.066 and this was considered to be statistically significant.

Hence the final change in CMT was higher in Group 1 (Canula method) than in Group 2 (Smith and Nozik technique) and this difference was found to be statistically significant.

Correlation between BCVA and CMT

The mean BCVA at the follow up visits was correlated with the mean central macular thickness on OCT in both the groups.

In group 1, **Pearson's Correlation Coefficient** value was -0.99,

signifying a **strong negative correlation** between mean BCVA and mean CMT, i.e. as the CMT decreases, the BCVA increases.

In group 2 also, Pearson's Correlation Coefficient value was -0.99, signifying a strong negative correlation between mean BCVA and mean CMT, i.e. as the CMT decreases, the BCVA increases.

6. Absolute value of mean IOP

IOP at	Group 1	Group 2
Baseline	14.27	14.93
Week 1	14.73	14.98
Week 6	14.93	15.37
Week 12	14.53	15.07

The average rise in intra-ocular pressure from the baseline in ***Group 1*** was analyzed after applying **Paired *t* test** (two tailed t test) and taking P value as < .05 as statistically significant.

N=15	Baseline	At week 6
Mean	14.27	14.93
SD	1.98	1.66
SEM	0.51	0.95

(SD= Standard deviation, SEM= Standard Error of Mean)

Two tailedP =0.0685 and this wasnotconsidered to be statisticallysignificant.

Hence a statistically significant rise in IOP doen not occur after posterior subtenon's injection of triamcinolone acetonide by canula method.

The average rise in IOP (week 6)) from the baseline in ***Group 2*** was also analyzed after applying **Paired *t* test** (two tailed t test) and taking P value as < .05 as statistically significant.

N=15	Baseline	At week 6
Mean	14.93	15.37
SD	1.53	1.51
SEM	0.40	0.44

(SD= Standard deviation, SEM= Standard Error of Mean)

Two tailed p value = 0.0323 and this wasnotconsidered to be statistically significant.

Hence a statistically significant rise in IOP (at week 6) does not occur after posterior subtenon's injection of triamcinolone acetonide by Smith and Nozik technique.

The difference between rise in IOP at week 6,from the baseline, attained in the two groups was also compared statistically after applying **Paired *t* test** (two tailed t test) and taking P value as < .05 as statistically significant.

N=15	Difference from baseline IOP at week 6 in group 1 (Canula method)	Difference from baseline IOP at week 6 in group 2 (Smith and Nozik technique)
Mean	0.66	0.44
SD	1.03	1.12
SEM	0.69	0.37

(SD= Standard deviation, SEM= Standard Error of Mean)

Two tailed p value = 0.67 and this difference was notstatistically significant.

Hence the rise in IOP at week 6 was **not** found to be statistically different between Group 1 (Canula method) and Group 2 (Smith and Nozik technique).

7. Average Pain Score

Pain Score	Group 1 (Cannula method)	Group 2 (Smith and Nozik technique)
Baseline	2.53	4.20

The average pain score in the two groups was compared statistically after applying **Paired *t* test** (two tailed t test) and taking P value as < .05 as statistically significant.

N=15	Pain score in group 1 (Canula method)	Pain score in group 2 (Smith and Nozik technique)
Mean	2.53	4.20
SD	0.64	1.01
SEM	0.17	0.26

(SD= Standard deviation, SEM= Standard Error of Mean)

Two tailed p value <0.01 and this difference was found to be statistically significant.

Hence pain score was significantly higher in group 2.

RESULTS

The subjects in our study were more males than females. Most were in the age group 41-60 years.

The most common indication for the posterior subtenon's triamcinolone injection was Diabetic CME (56%) followed by CME due to uveitis and pars planitis (24%) and then other causes of CME.

In this study, we found a statistically significant improvement in BCVA after posterior subtenon's injection of triamcinolone acetonide by both methods.

Also, the final change in best corrected visual acuity was higher in Group 1 (Canula method) than in Group 2 (Smith and Nozik technique) and this difference was found to be statistically significant.

On comparing the OCT findings, there is a statistically significant decrease in Central Macular Thickness after posterior subtenon's injection of triamcinolone acetonide by both methods.

The final change in CMT was found to be higher in Group 1 (Canula method) than in Group 2 (Smith and Nozik technique) and this difference was found to be statistically significant.

Analyzing the rise in intra-ocular pressure,there is no statistically significant rise in IOP (at week 6) after posterior subtenon's injection of triamcinolone acetonide by either of the two methods.

There was on subject in group 2 (Smith and Nozik method) who has a significant rise in intraocular pressure post-injection. This can be attributed to him being a steroid responder.

The pain score was significantly higher in group 2 (Smith and Nozik technique) compared to group 1 (canula method).

CONCLUSION

Macular edema is the most common sight-threatening complication of diabetic retinopathy and uveitis. This study compares the standard procedure with a procedure using PTFE canula instead of the 26 G needle.

In our study, most injections were given for diabetic cystoid macular edema (56.67%), followed by cystoid macular edema due to vitritis or pars planitis (23.33%) and then other causes like post surgical and following vascular occlusions (20%).

The significant improvement in best corrected visual acuity and the decrease in central macular thickness on OCT, in the Canula method group compared to Smith and Nozik method group by applying the paired t-test at p value <0.05, can be attributed to a

more posterior drug delivery, nearer to the macula, using the PTFE canula compared to the ½ inch, 26 G needle used in Smith and Nozik technique.

The pain score was lower in the canula method group as compared to the Smith and Nozik method group, and this difference was found to be statistically significant by applying the paired t-test at p value <0.05. This can be attributed to the polytetrafluoroethylene cannula being softer and more malleable than the rigid 26 G needle.

The rise in Intraocular pressure was not seen in either of the groups with no statistical difference between the groups.

The method of administering the posterior subtenon's triamcinolone injection did not have an effect on the rise in IOP.

Also, the incidence of serious complications like globe rupture, though not noted in our study can occur more with Smith and Nozik technique. This makes the procedure safer and the risk of globe perforation during injection is practically absent.

Hence our study suggests that the cannula method is an equally efficacious alternative to the more widely used Smith and Nozik method and may be safer, as a sharp needle is avoided after the initial entry done under visualization.

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